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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/858,241 | 05/15/2001 | Carlos L. Thompson | 10001214-1 | 3049 |

7590 05/27/2004

HEWLETT-PACKARD COMPANY
Intellectual Property Administration
P.O. Box 272400
Fort Collins, CO 80527-2400

EXAMINER

INGBERG, TODD D

| ART UNIT | PAPER NUMBER |
|----------|--------------|
|----------|--------------|

2124

DATE MAILED: 05/27/2004

3

Please find below and/or attached an Office communication concerning this application or proceeding.

Handwritten signature

Office Action Summary

Application No.

09/858,241

Applicant(s)

THOMPSON ET AL.

Examiner

Todd Ingberg

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 February 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 2/28/2002.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

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DETAILED ACTION

Claims 1 – 15 have been examined.

Information Disclosure Statement

1. The information disclosure statement filed February 8, 2002 has been considered.

Knowledge of the Artisan

2. One of ordinary skill in the art must understand the basics of compiler theory.

The basic college text book “Compilers Tools and Techniques”, by Aho et al. from September 1985 is considered grossly old and well known. This text book is not used in the rejection.

Claim Rejections - 35 USC § 102

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1 – 15 are rejected under 35 U.S.C. 102(b) as being anticipated by **Asuru** in the ACM publication, “Optimization of Array Subscript Range Checks” from 1992.

Claim 1

Asuru anticipates a computer-implemented method for verifying at runtime an invariant property of a data structure of a computer program, comprising: automatically generating a first code segment that verifies a runtime value of the data structure is consistent with the invariant property in response to an annotation of the data structure that defines the invariant property of the data structure; comparing the runtime value of the data structure with the invariant property during execution of the program via execution of the first code segment; and performing a programmed action if the runtime value is inconsistent with the invariant property.

Examiner's Rejection

Asuru anticipates the verifying of the loop invariant data structure at runtime(page 113 Range Check - Introduction) . The runtime range values are determined and replace the operands of the range (page 110 first paragraph). The upper and lower bounds the invariant property of the data structure as per above. The Range is used at runtime to ensure the loop invariant is not out of bounds with the subscripts (range) as per above.

Claim 2

The method of claim 1, wherein the invariant property is a range of data addresses and further comprising verifying that the runtime value of the data structure is within a range of data addresses specified in source code of the computer program.

Examiner's Rejection

See the rejection for claim 1 and page 112 of Asuru for range checking.

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Claim 3

The method of claim 1, wherein the invariant property is a range of data addresses and further comprising: automatically generating during compilation a valid data address range including an upper bound and a lower bound for the range of data addresses, wherein the source code of the computer program does not include a specification of the upper bound and lower bound; and verifying that the runtime value of the data structure is within the valid data address range.

Examiner's Rejection

As per claim 1.

Claim 4

The method of claim 1, wherein the invariant property is a range of instruction addresses and further comprising verifying that the runtime value of the data structure is within the range of instruction addresses specified in source code of the computer program.

Examiner's Rejection

As per claim 1 - inherent step – the range is stored in a variable. All entries in the symbol table have an address.

Claim 5

The method of claim 1, wherein the invariant property is a range of instruction addresses and further comprising: automatically generating during compilation a valid instruction address range including an upper bound and a lower bound for the range of addresses, wherein the source code of the computer program does not include a specification of the upper bound and lower bound; and verifying that the runtime value of the data structure is within the valid instruction address range.

Examiner's Rejection

Examiner interpretation – code can exist that does not need a range check. Such as a hard coded range which would use constant propagation and not the technique in the Asuru article. Constant propagation is considered an inherent feature of compiler theory.

Claim 6

The method of claim 1, wherein the invariant property is a range of data values and further comprising the step of verifying that the runtime value of the data structure is within the range of data values.

Examiner's Rejection

As per claim 1.

Claim 7

The method of claim 1, further comprising communicating the invariant property from a compiler to a code generator.

Examiner's Rejection

As per claim 1 - inherent step.

Claim 8

The method of claim 7, further comprising storing the invariant property in a symbol table.

Examiner's Rejection

As per claim 1 – Inherent the invariant is a loop control variable – all variables are inherently stored in the symbol table.

Claim 9

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The method of claim 8, wherein the invariant property is a range of data addresses and further comprising verifying that the runtime value of the data structure is within a range of data addresses specified in source code of the computer program.

Examiner's Rejection

As per claim 1 - inherent step – the range is stored in a variable. All entries in the symbol table have an address.

Claim 10

The method of claim 8, wherein the invariant property is a range of data addresses and further comprising: automatically generating during compilation a valid data address range including an upper bound and a lower bound for the range of data addresses, wherein the source code of the computer program does not include a specification of the upper bound and lower bound; and verifying that the runtime value of the data structure is within the valid data address range.

Examiner's Rejection

As per claim 1.

Claim 11

The method of claim 8, wherein the invariant property is a range of instruction addresses and further comprising verifying that the runtime value of the data structure is within the range of instruction addresses specified in source code of the computer program.

Examiner's Rejection

As per claim 1 - inherent step – the range is stored in a variable. All entries in the symbol table have an address.

Claim 12

The method of claim 8, wherein the invariant property is a range of instruction addresses and further comprising: automatically generating during compilation a valid instruction address range including an upper bound and a lower bound for the range of addresses, wherein the source code of the computer program does not include a specification of the upper bound and lower bound; and verifying that the runtime value of the data structure is within the valid instruction address range.

Examiner's Rejection

As per claim 1 - inherent step – the range is stored in a variable. All entries in the symbol table have an address.

Claim 13

The method of claim 8, wherein the invariant property is a range of data values and further comprising the step of verifying that the runtime value of the data structure is within the range of data values.

Examiner's Rejection

As per claim 1 - inherent step – the range is stored in a variable. All entries in the symbol table have an address.

Claim 14

The method of claim 8, further comprising storing in the symbol table one or more code addresses associated with one or more updates to the data structure.

Examiner's Rejection

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As per claim 1 - inherent step – the range is stored in a variable. All entries in the symbol table have an address. Symbol Tables inherently support updates and more than one symbol being defined.

4. Claim 15 is rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Runtime error for subscript out of range errors as taught by **Sirer** in the article Writing an Operating System with Modula-3 November 3, 1995.

Claim 15

An apparatus for verifying at runtime an invariant property of a data structure of a computer program, comprising: means for automatically generating a first code segment that verifies a runtime value of the data structure is consistent with the invariant property in response to an annotation of the data structure that defines the invariant property of the data structure; means for comparing the runtime value of the data structure with the invariant property during execution of the program via execution of the first code segment; and means for performing a programmed action if the runtime value is inconsistent with the invariant property.

Examiner's Rejection

Asuru anticipates the verifying of the loop invariant data structure at runtime(page 113 Range Check - Introduction) . The runtime range values are determined and replace the operands of the range (page 110 first paragraph). The upper and lower bounds the invariant property of the data structure as per above. The Range is used at runtime to ensure the loop invariant is not out of bounds with the subscripts (range) as per above. One of ordinary skill in the art should know that run time error checking is inherent and that subscript out of range errors generate an exception handler that invoke the operating.

In the event, the runtime environment error checking is challenged then the Examiner provides the MODULA Operating System reference by Sirer from November 3, 1995 Section 5 which proves providing for run time error checking such as bounds checking(page 3) is grossly old and well known. Therefore, it would be obvious to one of very ordinary skill in the art to combine Asuru and Sirer, because handling error correctly ensures programs run properly.

Correspondence Information

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Todd Ingberg** whose telephone number is (703) 305-9775. The examiner can normally be reached during the following hours:

| | | | | |
|-------------|------------|-------------|-----------|----------|
| Monday | Tuesday | Wednesday | Thursday | Friday |
| 6:15 – 1:30 | 6:15- 3:45 | 6:15 – 4:45 | 6:15-3:45 | 6:15-130 |

This schedule began December 1, 2003 and is subject to change.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Kakali Chaki** can be reached on (703) 305-9662. Please, note that as of August 4, 2003 the **FAX number** changed for the organization where this application or proceeding is assigned is **(703) 872-9306**.

Also, be advised the United States Patent Office **new address** is

Post Office Box 1450

Alexandria, Virginia 22313-1450

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-9700.

A handwritten signature in black ink, appearing to read 'Todd Ingberg', with a long, sweeping line extending from the end of the signature towards the top right of the page.

Todd Ingberg
Primary Examiner
Art Unit 2124
May 14, 2004